Keeping Genset Fuel Flowing During Disasters

Developing A Strategy To Ensure The Availability Of Fue System Is A Key Element Of Disaster Planning.

By Robert M. Menuet, PE, GHT Limited, Arlington, Va.

06/01/2011

Our commercial, government, and institutional operations depend on the continuous availability of electrical power to run critical equipment. Prolonged, large-scale power outages, though rare, have significant financial and service delivery impacts. You need to be ready when disaster strikes.

Disasters vary in type and severity. Fuel supply planning for local severe weather events and regional blackouts is vastly different from the strategies required to defend against an unforeseeable terrorist attack or an extraordinary natural catastrophe such as Hurricane Katrina. The considerations outlined in this article are intended to guide you through the planning process to defend against reasonably predictable disasters.

Diesel vs. natural gas

Diesel-fueled generators are better suited for larger power requirements than natural gas-powered generators, yet require more physical space and maintenance to sustain a reliable fuel source. Building owners typically select natural gas generators when they require a lower initial capital investment and prefer not to maintain an on-site fuel supply.

Because natural gas is supplied by the local utility and delivered underground, the primary factor that building owners can control in relation to disaster defense is the purchase of non-interruptible service. Your utility will typically charge a slightly higher rate in exchange for a guarantee of fuel availability during a local disaster event, but many owners find this preferable to managing a diesel fuel supply for their generator.

When choosing between natural gas and diesel, it is important to note that natural gas generators may not satisfy local life safety requirements. If the utility source is not deemed reliable for emergency operations by the local authority, diesel engine generators are generally the only practical alternative.

For buildings that shelter critical business functions or have other high availability requirements, the decision to use an on-site diesel-powered generator is often made as part of overall disaster planning (Figure 1). Once this choice is made, there are numerous factors that can influence the configuration of the fuel supply. Considerations that can make this process more manageable include:

- Fuel quantity
- Refueling availability
- Storage and compartmentation
- Fuel quality
- Safety and security

Fuel quantity

Identifying the amount of fuel needed to power your critical equipment during a reasonably predictable natural catastrophe is the first step. A rough consumption calculation for diesel generators is 7 gallons of fuel per hour for each 100 kW of generator rating; i.e., a 200 kW generator would consume 14 gallons of diesel fuel per hour. A typical goal for on-site storage is three days' worth of fuel. A site requiring a 2 MW generator installation should have approximately 10,000 gallons of available stored fuel to provide a three-day supply. To ensure the necessary amount is on hand in the event of a disaster, you should factor engine exercising into your equation, and understand that refilling a partially depleted storage tank may not be practical until sufficient fuel is depleted to justify a fuel delivery. Purchase a storage system that will accommodate your disaster-threshold fuel plus the amount you will consume for engine testing as part of regular maintenance.

When determining the amount of fuel to store on-site, you must consider the criticality of your location and the nature of your operation at the site. If your facility provides critical functions required for your business that are not duplicated in another location, a larger quantity of fuel should be considered to ensure continued operations during an extended power outage. Consider the impact an extended utility outage would have on your organization's bottom line. The data center of an online retailer would likely face far greater revenue losses during an extended power outage than the administrative office of a sales force that telecommutes and travels on a regular basis. Storing fuel can be expensive, so a business case should be developed that considers capital expenses and risk factors. Weigh the installation costs and maintenance requirements of storing fuel against the financial impacts of downtime—including the direct costs of lost revenue, recovery of operations, and the potential loss of customers.

According to the American Red Cross, "As many as 40% of small businesses do not reopen after a major disaster like a flood, tornado, or earthquake. These shuttered businesses were unprepared for a disaster; they had no plan or backup systems."

Refueling availability

Refueling availability will impact your decision on how much fuel to store on-site. Is it financially and logistically feasible to store all or some of the desired amount in your building or on your property? Can you arrange to have a supplier outside of the region bring fuel when needed? In the second scenario, the fuel supplier down the street may be affected by the same natural disaster, so arranging delivery assurances from several geographically disparate suppliers may make sense. Selecting remote suppliers that use different transportation routes can further ensure refueling availability when a disaster has a widespread impact. Typically it is not practical—logistically or economically—to store more than several days' supply on-site, so a balance between on-site storage and delivery assurances from suppliers should position you to survive an extended loss of electrical power.

Storage and Compartmentation

On-Site Storage—For the fuel you store on-site, the first consideration is conforming to local and state codes, Environmental Protection Agency (EPA) regulations, and National Fire Protection Association guidelines. Codes are intended to safeguard buildings and their occupants, while EPA is primarily concerned with the environmental impact of spills. Sustainable design certifications that encompass building energy usage, such as the U.S. Green Building Council LEED program, may also influence how much and where the fuel is stored.

The amount of on-site fuel storage will likely dictate storage locations and configurations (Figure 2). Large amounts of fuel are typically stored outside the building, either in above- or below-ground tanks. Below-grade storage requires EPA compliance for leak monitoring, and may necessitate groundwater monitoring and other spill detection methods. Local and state codes may have additional requirements for outdoor storage solutions.

For outdoor generators, engineers often specify that the fuel be stored in belly tanks under the generator. This can be a convenient, space-saving option, though there is a practical limit to the amount of fuel a belly tank can hold. If a tank is too large, stairs, platforms, or ladders may be required to gain access to service the generator. If a belly tank is too small, your operating time will be limited if it is your only method of storage. Discuss these considerations with your operations and maintenance staff.

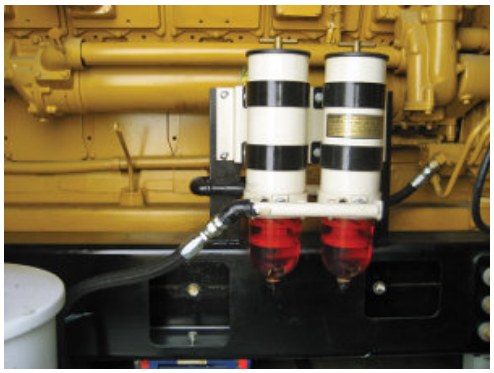
In-building storage may be the best solution for smaller amounts of stored fuel (Figure 3). It also offers better protection from temperature fluctuations, weather events, and tampering. An example from Hurricane Katrina illustrates this point. As noted in "FAILURE OF INITIATIVE: Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina," "Many of the parish EOCs [Emergency Operations Centers] and public safety facilities were wiped out or flooded. Jefferson Parish…was in better shape to respond because it had protected its EOC. Jefferson Parish Emergency Manager Dr. Walter Maestri explained the EOC was in a hardened facility—an old incinerator with cement walls—with the command center, living quarters, and emergency generator all on upper floors...[and] it was able to keep operating at some level."

Fuel stored within your facility will require compliance with building codes, local and state codes, and building insurance requirements. Building and structure insurance policies often have strict requirements for the type and amount of fuel and storage equipment.

Compartmentation—While compliance with building codes and other mandatory requirements will result in a safe installation, there are other choices a user can make to improve the availability of the stored fuel. Compartmentation can help safeguard some or all of your reserve if a single localized event occurs, such as an explosion or fire. With compartmentation, the total amount of fuel is divided among multiple tanks. Fire- and blast-resistant separating-structures ensure there are barriers between tanks to prevent a local event from affecting the entire supply.

Compartmentation also supports the availability of backup fuel if one tank develops quality problems. Also, the use of multiple storage vessels helps limit cross-contamination should one tank be replenished with contaminated fuel.

Fuel quality



If you store fuel on-site, consider installing a fuel filtering or polishing system that will remove moisture and help prevent fuel degradation (Figure 4). Sediment that can build up in the bottom of storage tanks can be stirred up when fuel is delivered, often resulting in clogged filters and injectors, or decreased engine performance.

Fuel polishing and filtration helps minimize this buildup. Also consider fuel additives that will prolong fuel life, suspend contaminants so they can be trapped by the system filters, protect against corrosion, and prevent biological growths.

Temperature Considerations—Atmospheric temperatures can affect fuel quality. At approximately 30 F, fuel begins to cloud as the paraffin in the fuel starts to solidify. At 15 F, this solidification can turn into wax and can be severe enough to clog filters in the system.

Most providers offer winter blends designed to minimize clouding. If financial or logistical reasons necessitate the use of a summer blend fuel as you enter colder weather, other strategies to prevent this problem include additives, heat trace of piping, and immersion tank heaters.

Safety and security

Ensuring the safety of building occupants and the security of your fuel supply is fairly straightforward. During facility design, provide a rated room for fuel and generators stored in the building. Locate it near a loading dock or other low-traffic area, and provide controlled access. When using outdoor storage, critical facilities will likely have perimeter security in place to safeguard their fuel supply and generators. For less intensive facilities, secure walls or fencing around the fuel storage tanks is the most common protection strategy.

Planning ahead

It is impossible to predict every disaster scenario that could impact your fuel supply. But with early, careful planning, you can determine the amount, availability, storage, protection, and quality of a fuel supply that can support your operations through many of the most common natural catastrophes that occur in your region. A balanced strategy that considers costs and risks will ensure the success of your plan.

Menuet is a senior principal with GHT Limited, where he focuses on the design of mission-critical facilities for many clients with high availability needs. A professional engineer with more than 26 years of experience, he earned a Bachelor of Science in Mechanical Engineering from the University of Virginia.

Disaster Planning Resources

American Red Cross: Safeguarding your fuel supply, power sources, and facility is only the beginning of disaster planning for your organization. Protecting people is the most critical element. The American Red Cross website provides advice on preparing workplaces and employees in the *Preparing and Getting Trained* section.

The *Preparing and Getting Trained* section also provides information on training for companies and organizations under *Take a Class*.

Disaster Recovery Journal: The words *disaster* and *catastrophe* have different meanings based on context and individual perception. When preparing a disaster response plan, it is helpful to establish a common language to ensure clarity in communications. The DRJ website provides a glossary in the *Tools* section that could be useful in developing your organizational disaster vocabulary.

The *Tools* section also features a downloadable spreadsheet of global rules and regulations pertaining to business continuity and a cache of sample disaster recovery plans that can be used as a template.

Federal Emergency Management Agency (FEMA): FEMA provides an extremely comprehensive guide to organizational disaster planning. *Emergency Management Guide for Business and Industry: A Step-by-Step Approach to Emergency Planning, Response and Recovery for Companies of All Sizes* is available at www.fema.gov/business.

FEMA is also an excellent source for disaster-specific data and maps. Learn more about the different types of hazards and the risks in your geographic region in the *Disasters and Maps* section.

The Institute for Business and Home Safety (IBHS) Disaster Safety Service: IBHS' Disaster Safety service provides numerous organizational planning tools and resources, including:

- Quick access to state-by-state building codes
- A *10 Questions: Is Your Business Ready?* quiz to help you understand your risk factors should disaster strike
- Real-world stories from people who successfully protected their homes and businesses during a disaster.

Related News:

Mississippi gains new commissioned facilities - 26.07.2011 09:58
Setting up an emergency communication system - 08.04.2011 00:00
Seismic codes for nonstructural engineering - 08.03.2011 15:07

<- Back to: More Top Stories